



## CEAC and ASA(ALT) A Partnership for Our Soldier

# CAIV Analysis Tool

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# Agenda

- The Army CAIV Vision, *Mr. Mort Anvari*
- Sample CAIV Graphs
- CAT System Concept
- CAT User Menu
  - Enter Schedule
  - Enter Component Cost Information
  - Enter Component Performance Information
- Select the Best Value Components
- Other Graphs provided by CAT
- Conclusion – The Army CAIV Vision



# The Army CAIV Vision

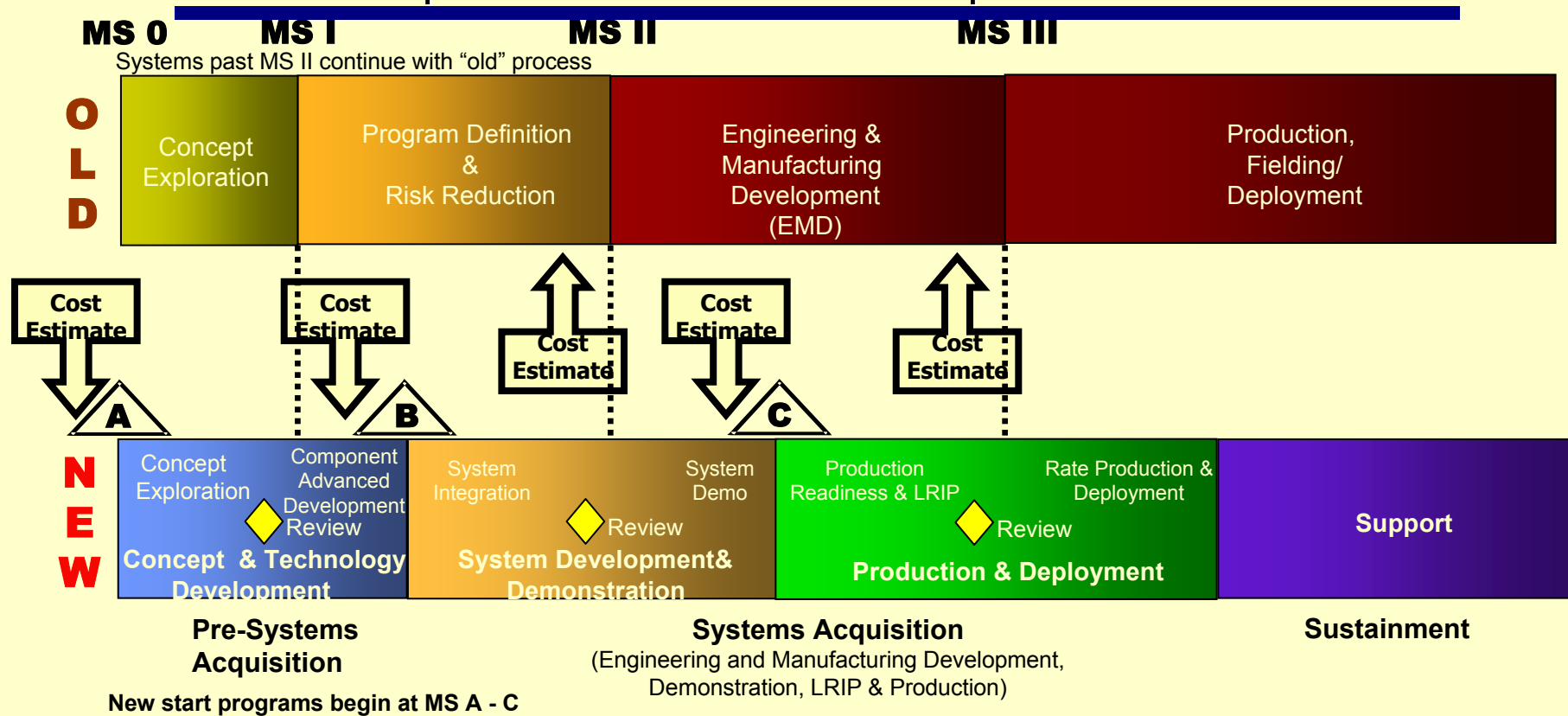
U.S. Army  
Cost and Economic Analysis Center

Mr. Mort Anvari



# When Cost Estimates are Prepared Weapons/Information Systems

## Comparison of Old vs. New Acquisition Process

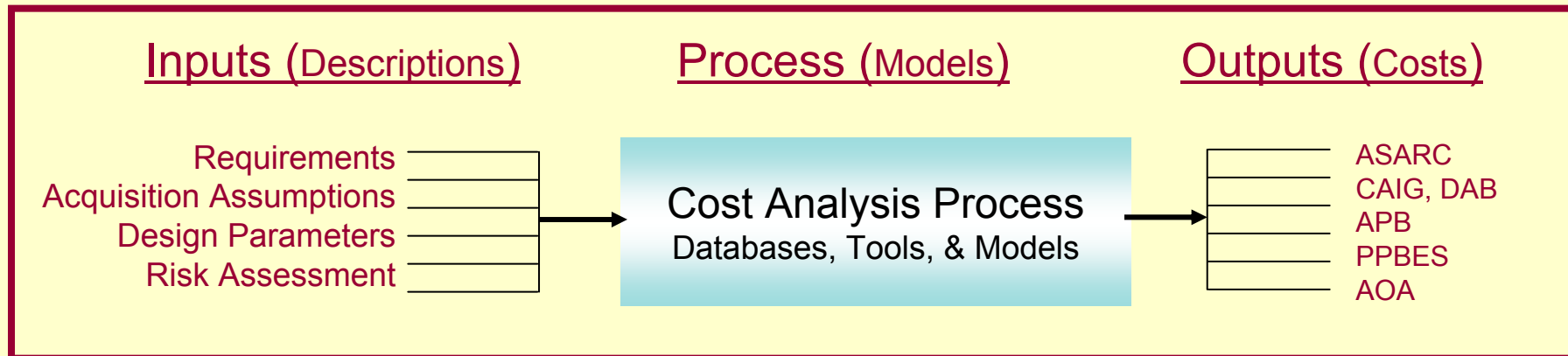


### NEW Cost Analysis

- Influences Design
- Implements CAIV
- Demands Design-Based and Performance-Based CERs
- Demands Component-Level Cost Models
- Supports SMART Initiatives



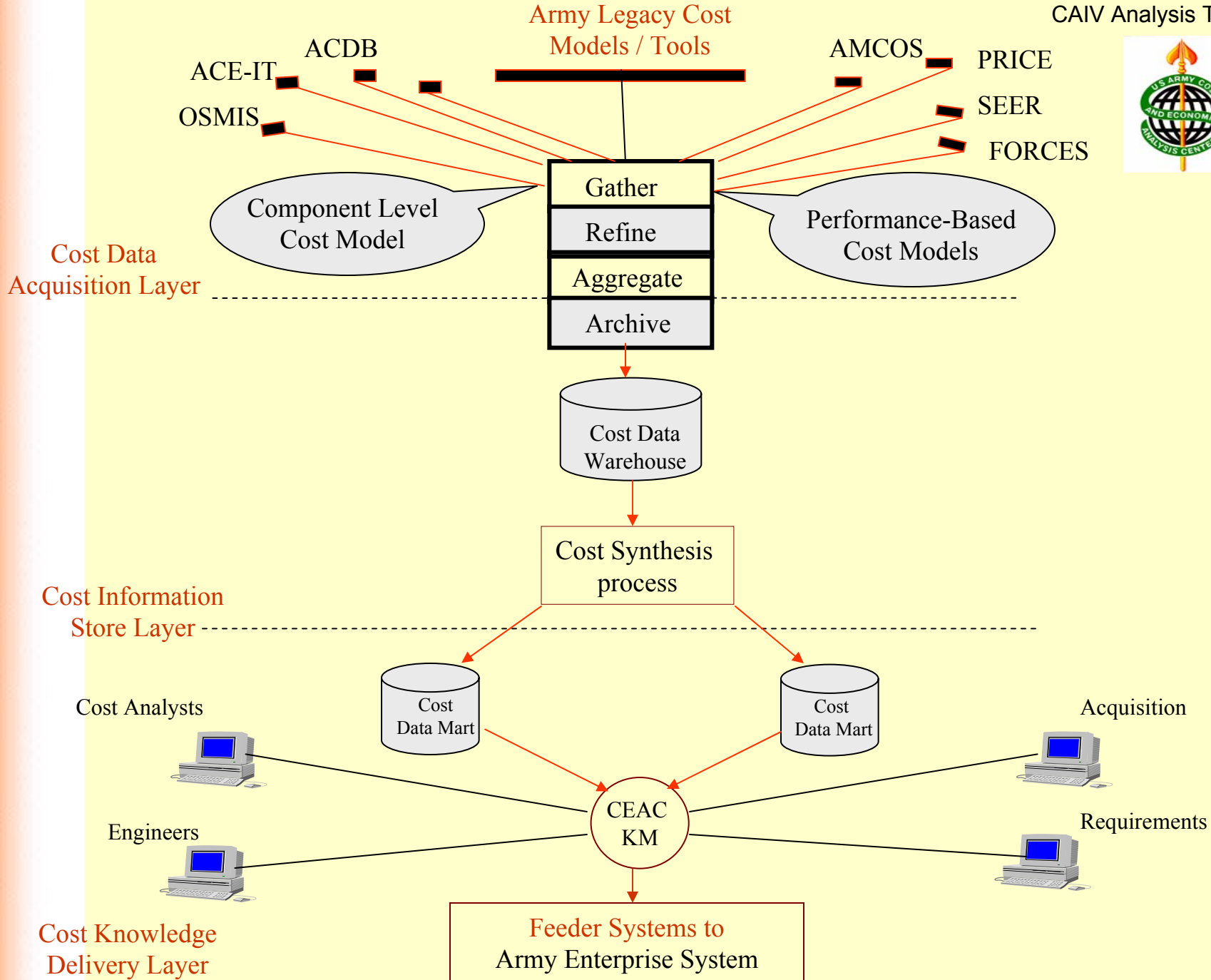
# Cost Analysis Domain



## Types of Cost Studies

	Studies	Should be Known	Unknown	Class
Current Capability	Cost Estimating	Descriptions, Models	Costs	Analysis
	CER Development	Description, Historical Costs	Models	Synthesis
Needed Capability	CAIV	Cost Goals, <b>Models</b>	Descriptions ( Design and Performance Parameters)	Control

Performance Based and Design Based Cost Models Currently do not Exist





# Cost As An Independent Variable (CAIV)

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PARADIGM	FIXED Independent Variable	VARIABLE Dependent Variable
Old-”Business as usual”	Performance	Tech Design, Schedule,& Cost
Design to Cost	Performance & Cost	Tech Design & Schedule
New CAIV	Life Cycle Cost	Performance, Tech Design,& Schedule



# Cost As An Independent Variable (CAIV)

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What is the Cost Analyst's role?

- Cost Analyst plays active role in CAIV implementation.
- Cost Analyst provides “order-of-magnitude” estimate at pre-milestone 0 concept stage...cost to bring emerging technologies from the technology base to full scale development.
- Cost Analyst estimates the cost of new technologies in production and operation. These early estimates play critical role in rankings of the Analysis of Alternatives (AoAs).



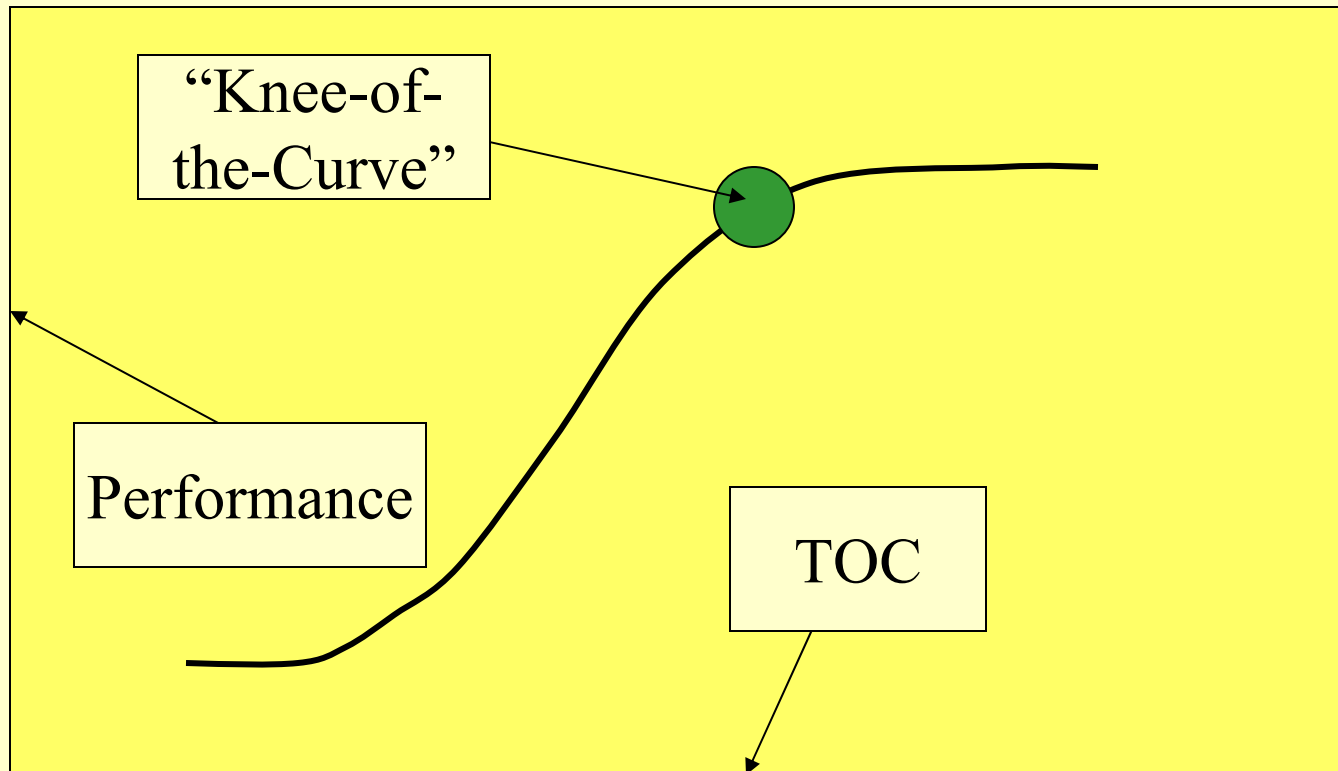


# Sample CAIV Graphs

Colonel Terrell W. Mathews, Ph.D.  
Assistant Secretary of the Army  
(Acquisition, Logistics, Technology)



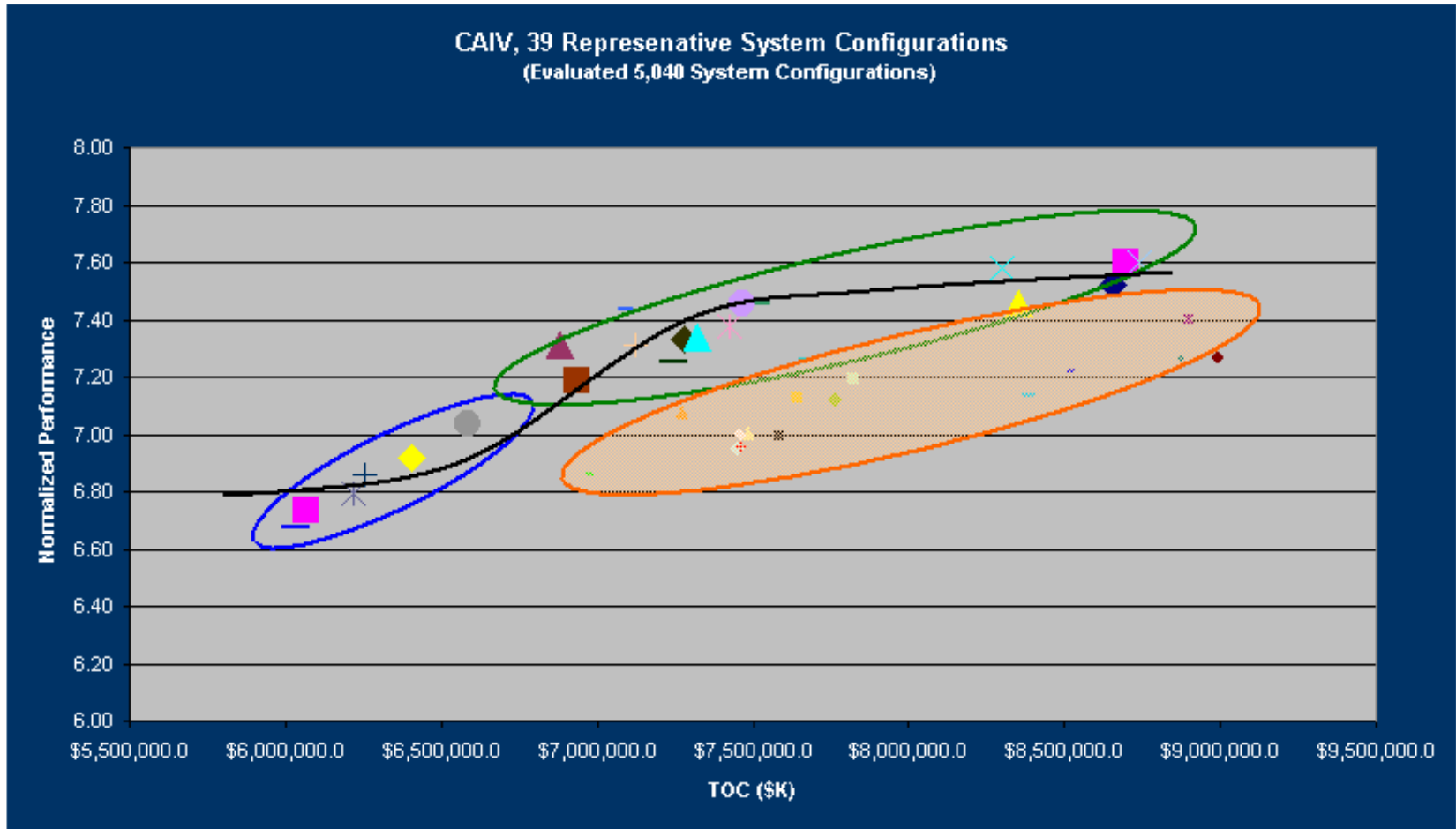
# Typical CAIV Curve



*CAT plots Performance as a function of Total-Ownership-Cost (TOC).*



# Sample System Analysis



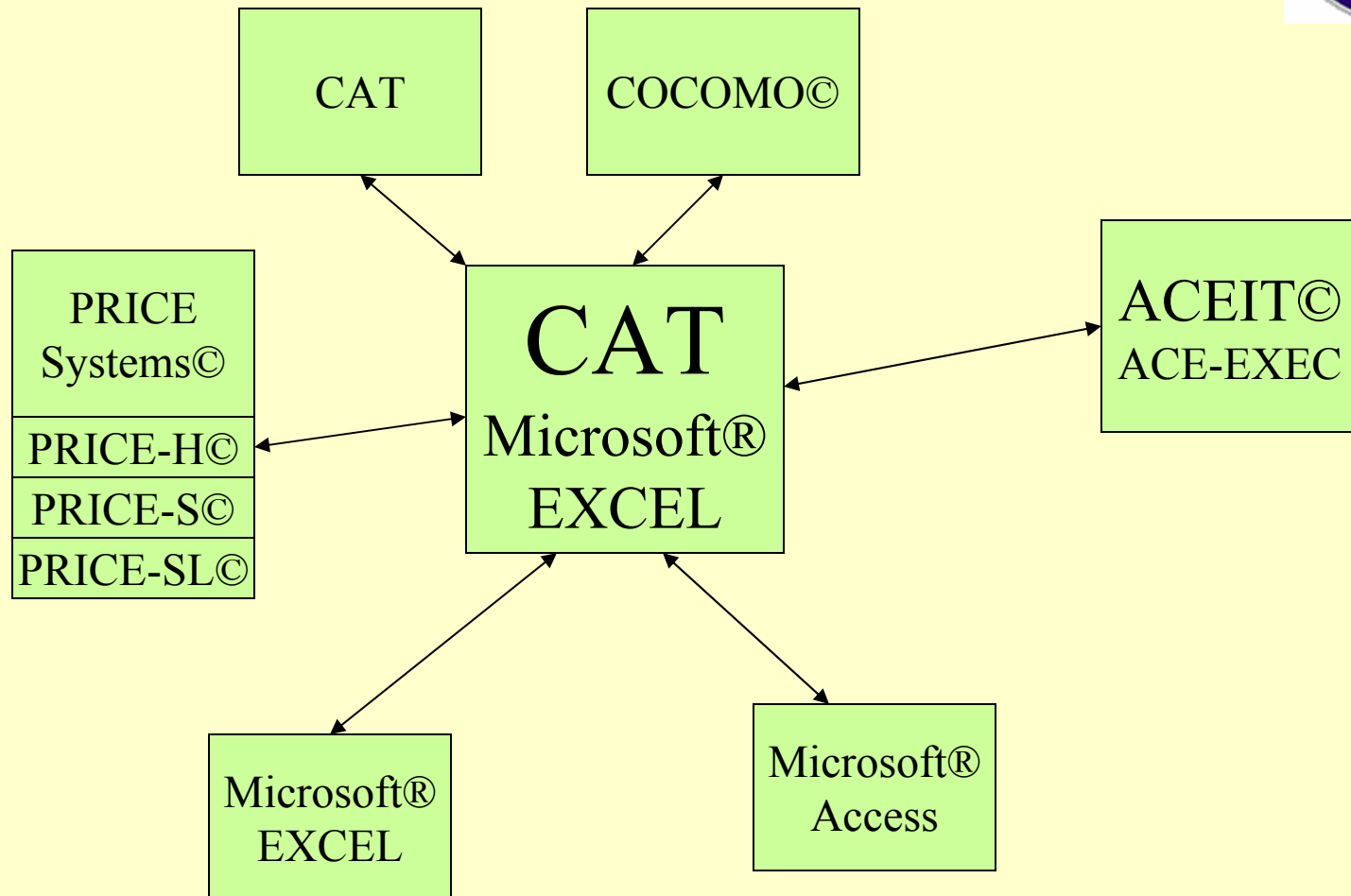
*One may access CAT data to compare various system configurations.*



# CAT System Concept



# CAT Conceptual Environment



*CAT shares information with numerous other Microsoft® based tools.*



# DoDI 5000.2 (23 Oct 2000)

Microsoft Excel - CAT - Generic Aircraft System

File Edit View Insert Format Tools Data Window Help

A7 = Concept Exploration

	A	B	C	D
5	SCHEDULE	v Months-----Fiscal Years>	2000	2001
6	Concept & Technical Development	0		
7	Concept Exploration	0		
8	Component Advanced Development	0		
9	System Development & Demonstration	0		
10	System Integration	0		
11	System Demonstration	0		
12	Production & Deployment	0		
13	Production Readiness & LRIP	0		
14	Full Rate Production & Deployment	0		
15	Operations and Support	0		
16	Sustainment	0		
17	Demilitarization and Disposal	0		
18				
19				
20				
21				
22				
23				
24				
25				
26	TOC Confirm			
27				
28	Line Item	Current Configuration	TOC (\$K)	RDT&E
29		Configuration TOC	0.0	0.0
30			0.0	0.0

Cell A7 commented by Terrell W. Mathews

NUM

Pop-up Definitions

RDT&E  
Procurement  
OMA  
MilPer  
MilCon

4.7.2.4.3. -- Concept Exploration  
4.7.2.4.3.1. Concept Exploration typically consists of competitive, parallel, short-term concept studies. The focus of these efforts is to define and evaluate the feasibility of alternative concepts and to provide a basis for assessing the relative merits (i.e. advantages and disadvantages, degree of risk, etc.) of these concepts. Analyses of alternatives shall be used to facilitate comparisons of alternative concepts.  
4.7.2.4.3.2. In order to achieve the best possible system solution, emphasis will be placed on innovation and competition. To this end, participation by a diversified range of businesses (i.e., small, new, domestic, and international) should be encouraged. Alternative system design concepts will be primarily solicited from private industry and, where appropriate, from organic activities, international technology and equipment firms, Federal laboratories, federally funded research and development centers, educational institutions, and other not-for-profit organizations.  
4.7.2.4.3.3. The work in Concept Exploration normally shall be funded only for completion of concept studies contracts. The work shall be guided by the MNS.  
4.7.2.4.3.4. The most promising system concepts shall be defined in terms of initial, broad objectives for cost, schedule, and performance; identification of interoperability, security, survivability, operational continuity, technology protection, operational support, and infrastructure requirements within a family of systems; opportunities for tradeoffs, and an overall acquisition strategy and test and evaluation strategy (including Development Test and Evaluation (DT&E), Operational Test and Evaluation (OT&E), and Live Fire Test and Evaluation (LFT&E)). The DoD Components shall also consider initiating government-to-government efforts to develop international cooperation in attaining the most promising system concepts.  
4.7.2.4.3.5. This work effort ends with a review, at which the MDA selects the preferred concept to be pursued for which technologies are available.

*CAT complies with the latest version of DOD 5000.1.*



# Mil-HNBK-881B WBS

Microsoft Excel - CAT - Generic Surface System

File Edit View Insert Format Tools Data Window Help

A5 = Concept & Technical Development

	A	B	C	D	E	F
1	IPT Member: 0					
2	POC Name and phone #: 0					
3	Insert the total cost (\$K) for the product alternative.					
4	WBS Title	WBS	BY2002	TOTAL	2000	2001
5	Concept & Technical Development	1	OUTPUT	0.0	0.0	0.0
6	Concept Exploration	1.1	OUTPUT	0.0	0.0	0.0
7	PRIMARY VEHICLE	1.1	OUTPUT	0.0	0.0	0.0
8	HULL/FRAME	1.1.1	OUTPUT	0.0	0.0	0.0
17	SUSPENSION/STEERING	1.1.1.1	OUTPUT	0.0	0.0	0.0
27	PWR PKG/DRIVE TRAIN	1.1.1.2	OUTPUT	0.0	0.0	0.0
44	AUX AUTOMOTIVE SYS	1.1.1.3	OUTPUT	0.0	0.0	0.0
53	TURRET ASSEMBLY	1.1.1.4	OUTPUT	0.0	0.0	0.0
62	FIRE CONTROL SYS	1.1.1.5	OUTPUT	0.0	0.0	0.0
71	ARMAMENT	1.1.1.6	OUTPUT	0.0	0.0	0.0
	BODY/CAB	1.1.1.7	OUTPUT	0.0	0.0	0.0
	AUTO LOADING SYS	1.1.1.8	OUTPUT	0.0	0.0	0.0
	AUTO/REMOTE PILOT SYS	1.1.1.9	OUTPUT	0.0	0.0	0.0
	NUCL/BIO/CHEM SYS	1.1.1.10	OUTPUT	0.0	0.0	0.0
	SPECIAL EQUIPMENT	1.1.1.11	OUTPUT	0.0	0.0	0.0
	NAVIGATION EQUIP	1.1.1.12	INPUT	0.0	0.0	0.0
91	COMM EQUIP	1.1.1.13	INPUT	0.0	0.0	0.0
92	INTEG/ASSY/TEST/CHKOUT	1.1.1.14	OUTPUT	0.0	0.0	0.0
95	OTHER	1.1.1.15	INPUT	0.0	0.0	0.0
96	Operational Model	1.1.2	OUTPUT	0.0	0.0	0.0
113	Engineering Model	1.1.3	OUTPUT	0.0	0.0	0.0

Cell A8 commented by Terrell W. Mathews

NUM

Pop-up  
Definitions

HULL/FRAME - The hull/frame element refers to the vehicle's primary load bearing component which provides the structural integrity to withstand the operational loading stresses generated while traversing various terrain profiles. This element could be a simple wheeled vehicle frame or a more complicated combat vehicle hull which satisfies not only the structural requirements but also provides armor protection. It includes all structural subassemblies and appendages which attach directly to the primary structure. This element, for example, includes towing and lifting fittings, bumpers, hatches and grilles. It also includes provision to accommodate other subsystems such as mountings for suspension, weapons, turret, truck body, cab, special equipment loads, etc. All effort directly associated with the remaining level 3 elements and the integration, assembly, test and checkout of these elements into the primary vehicle is excluded.

*CAT complies with the latest version of Mil-HNBK-881B.*



# CAT User Menu





# CAT Start Menu

Generic Aircraft System **CAT** Beta Version 1.0  
5Apr2001

**CAIV Analysis Tool**

ARTOC - Army Total Ownership Cost  
CAIV - Cost as an Independent Variable

IPT Member:  
POC Name and phone #:

**Depress Button**

**POC** Step 1: Enter the Point-of-Contact's Information.  
**Desc** Step 2: Enter the Product's Description.  
**Schedule** Step 3: Enter the Start Year and Program Schedule  
**MEI** Step 4: Enter the number of Major End Items (MEI) per Battalion.  
**Fielding** Step 5: Enter the Battalion Fielding Plan.  
**Disposal** Step 6: Enter the Battalion Disposal Plan  
**Procure** Step 7: Enter the number of MEIs that will preprocured in each FY.  
**Pers** Step 8: Enter the number of and cost for personnel in a battalion.  
Step 9: Enter the cost for each sub-system.

Airframe	Propulsion	Appl SW	Sys SW	Comm	Navigation	Central CP	FCS	Display	Op Model
Survival	Recon	Auto Flight	Cent Integ	AntiSub	Armament	Weapons	Aux Equip	Environ	Engr Model

Step 10: Enter the Performance Parameters for each sub-system.

Airframe	Propulsion	Appl SW	Sys SW	Comm	Navigation	Central CP	FCS	Display
Survival	Recon	Auto Flight	Cent Integ	AntiSub	Armament	Weapons	Aux Equip	

**Fuel** Step 11: Enter the Fuel Cost.  
Step 12: View the CAIV (Cost-as-an-Independent-Variable) Charts.

Airframe	Propulsion	Appl SW	Sys SW	Comm	Navigation	Central CP	FCS	Display
Survival	Recon	Auto Flight	Cent Integ	AntiSub	Armament	Weapons	Aux Equip	

Step 13: Select the sub-systems.

Airframe	Propulsion	Appl SW	Sys SW	Comm	Navigation	Central CP	FCS	Display
Survival	Recon	Auto Flight	Cent Integ	AntiSub	Armament	Weapons	Aux Equip	

Step 14: View the Acquisition Phase and Fund Information.

C&DT	SD&D	P&D	O&S	Fund
------	------	-----	-----	------

*One points and clicks through the Data-Entry-Menus.*



# Schedule Information

Start  
FY

IPT Member: 0					
POC Name and phone #: 0		MODIFY only GREEN cells.			
SCHEDULE	v Months-----Fiscal Years>	2000	2001	2002	2003
Concept & Technical Development	0	0	0	0	0
Concept Exploration	0				
Component Advanced Development	0				
System Development & Demonstration	0	0	0	0	0
System Integration					
System Demonstration					
Production & Deployment	0	0	0	0	0
Production Readiness & LRIP					
Full Rate Production & Deployment					
Operations and Support	0	0	0	0	0
Sustainment					
Demilitarization and Disposal					

Number  
of Months  
for each  
Sub-phase

*CAT vectors the user to the "Schedule" Menu.*



# CAT Cost Menu

Generic Aircraft System **CAT** Beta Version 1.0  
5Apr2001

**CAIV Analysis Tool**

ARTOC - Army Total Ownership Cost  
CAIV - Cost as an Independent Variable

IPT Member:  
POC Name and phone #:

**Depress Button**

**POC** **Desc** **Schedule** **MEI** **Fielding** **Disposal** **Procure** **Pers**

**Step 1:** Enter the Point-of-Contact's Information.  
**Step 2:** Enter the Product's Description.  
**Step 3:** Enter the Start Year and Program Schedule  
**Step 4:** Enter the number of Major End Items (MEI) per Battalion.  
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**Step 6:** Enter the Battalion Disposal Plan  
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Airframe	Propulsion	Appl SW	Sys SW	Comm	Navigation	Central CP	FCS	Display	Op Model
Survival	Recon	Auto Flight	Cent Integ	AntiSub	Armament	Weapons	Aux Equip	Environ	Engr Model

**Step 10:** Enter the Performance Parameters for each sub-system.

Airframe	Propulsion	Appl SW	Sys SW	Comm	Navigation	Central CP	FCS	Display
Survival	Recon	Auto Flight	Cent Integ	AntiSub	Armament	Weapons	Aux Equip	

**Fuel** **Step 11:** Enter the Fuel Cost.  
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Airframe	Propulsion	Appl SW	Sys SW	Comm	Navigation	Central CP	FCS	Display
Survival	Recon	Auto Flight	Cent Integ	AntiSub	Armament	Weapons	Aux Equip	

**Step 13:** Select the sub-systems.

Airframe	Propulsion	Appl SW	Sys SW	Comm	Navigation	Central CP	FCS	Display
Survival	Recon	Auto Flight	Cent Integ	AntiSub	Armament	Weapons	Aux Equip	

**Step 14:** View the Acquisition Phase and Fund Information.

C&DT	SD&D	P&D	O&S	Fund
------	------	-----	-----	------

*One points and clicks to get to the Cost entry Menu.*



# Component Cost

<b>Airframe</b>								
Column Ref.								
1	2	3	4	5	6	8	9	
The following table defines the alternative products.								
USE	Product #	Manufacturer	Type	RDT&E Cost (\$K) per product	Procurement Cost (\$K) per product	Annual ILS Cost (\$K) per Product	Annual Training Cost (\$K) per Product	
use	1	Acme	Airframe 1					
	2							
	3							
	4							

Link to/from  
another  
Tool, e.g.  
PRICE-S©

Enter the  
Component  
Information

*CAT vectors the user to the Component Cost Menu .*



# CAT Performance Menu

Generic Aircraft System **CAT** Beta Version 1.0  
5Apr2001

**CAIV Analysis Tool**  
ARTOC - Army Total Ownership Cost  
CAIV - Cost as an Independent Variable

IPT Member:  
POC Name and phone #:

**Depress Button**

**POC** **Desc** **Schedule** **MEI** **Fielding** **Disposal** **Procure** **Pers**

**Step 1:** Enter the Point-of-Contact's Information.  
**Step 2:** Enter the Product's Description.  
**Step 3:** Enter the Start Year and Program Schedule  
**Step 4:** Enter the number of Major End Items (MEI) per Battalion.  
**Step 5:** Enter the Battalion Fielding Plan.  
**Step 6:** Enter the Battalion Disposal Plan  
**Step 7:** Enter the number of MEIs that will precured in each FY.  
**Step 8:** Enter the number of and cost for personnel in a battalion.  
**Step 9:** Enter the cost for each sub-system.

Airframe	Propulsion	Appl SW	Sys SW	Comm	Navigation	Central CP	FCS	Display	Op Model
Survival	Recon	Auto Flight	Cent Integ	AntiSub	Armament	Weapons	Aux Equip	Environ	Engr Model

**Step 10:** Enter the Performance Parameters for each sub-system.

Airframe	Propulsion	Appl SW	Sys SW	Comm	Navigation	Central CP	FCS	Display
Survival	Recon	Auto Flight	Cent Integ	AntiSub	Armament	Weapons	Aux Equip	

**Fuel** **Step 11:** Enter the Fuel Cost.  
**Step 12:** View the CAIV (Cost-as-an-Independent-Variable) Charts.

Airframe	Propulsion	Appl SW	Sys SW	Comm	Navigation	Central CP	FCS	Display
Survival	Recon	Auto Flight	Cent Integ	AntiSub	Armament	Weapons	Aux Equip	

**Step 13:** Select the sub-systems.

Airframe	Propulsion	Appl SW	Sys SW	Comm	Navigation	Central CP	FCS	Display
Survival	Recon	Auto Flight	Cent Integ	AntiSub	Armament	Weapons	Aux Equip	

**Step 14:** View the Acquisition Phase and Fund Information.

C&DT	SD&D	P&D	O&S	Fund
------	------	-----	-----	------

*One points and clicks to get to the Performance entry Menu.*



# Component Performance

Link to/from Another Tool

KPP #1 Interoperability						
Parameter	Parm #1	Parm #2	Parm #3	Parm #4	Parm #5	Raw Score
Weighting	100	0	0	0	0	100
Actual Value >	10.0	10.0	10.0	10.0	10.0	
	10.0	10.0	10.0	10.0	10.0	10.0
	20.0	20.0	20.0	20.0	20.0	9.0
	30.0	30.0	30.0	30.0	30.0	8.0
	40.0	40.0	40.0	40.0	40.0	7.0
	50.0	50.0	50.0	50.0	50.0	6.0
	60.0	60.0	60.0	60.0	60.0	5.0
	70.0	70.0	70.0	70.0	70.0	4.0
	80.0			80.0	80.0	3.0
	90.0			90.0	90.0	2.0
	100.0			100.0	100.0	1.0
Param Scores	10.00			10.00	10.00	MOE Score
Wt'd Scores	1000.0			0.0	0.0	10.0
Wt'd Scores	1000.0			0.0	0.0	10.0
Wt'd Scores	1000.0			0.0	0.0	10.0

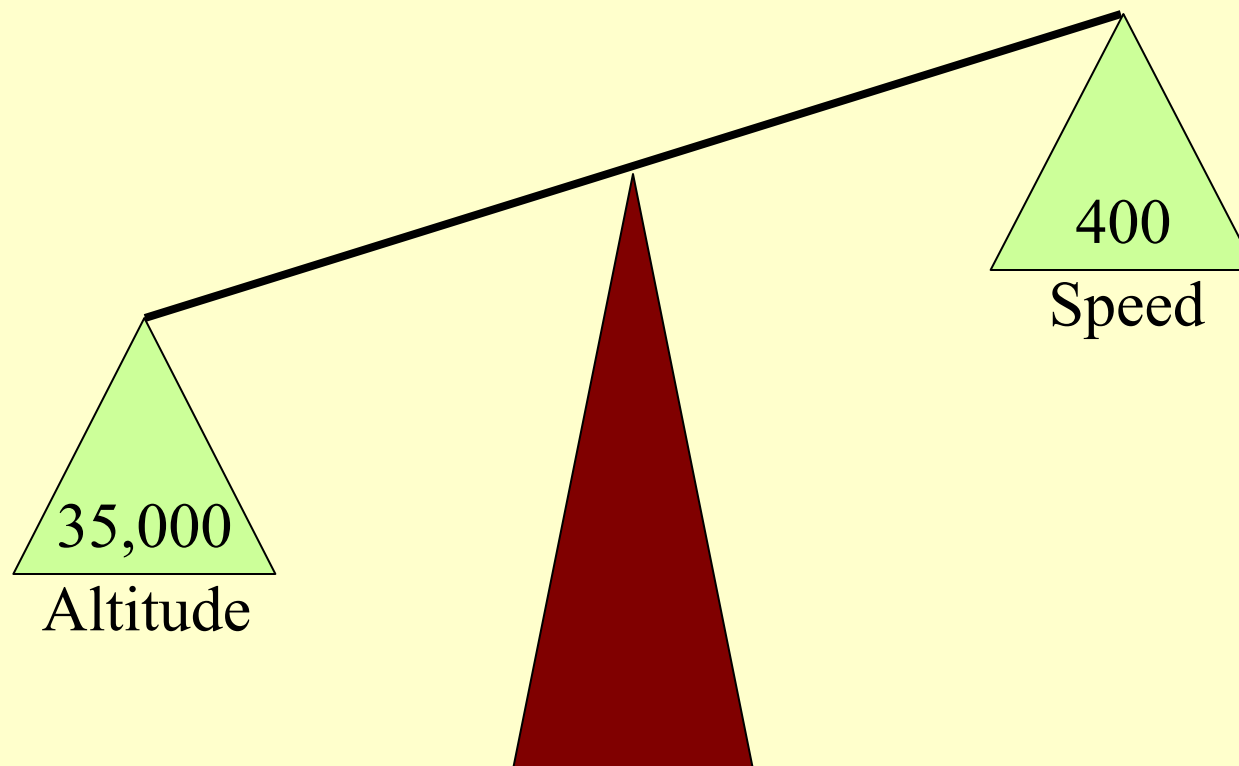
Enter the Component Information

*CAT vectors the user to the Component Performance Menu .*



# Inherent Weighting

MOE/MOP – Airborne System shall reconnoiter x-sqmi in y-hr.



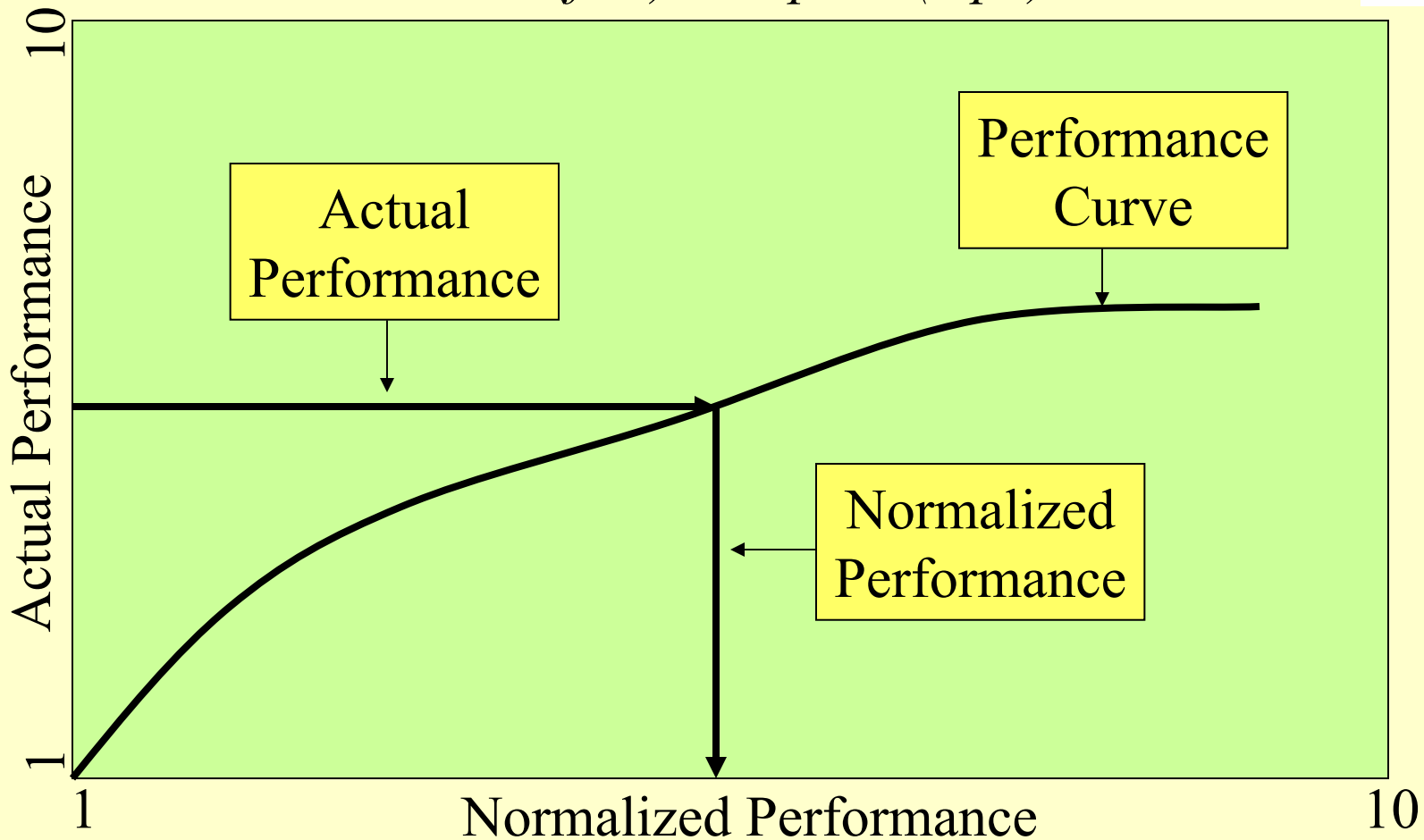
*Inherent weighting anomalies can occur without normalization.*





# Performance Normalization

*Altitude (feet) vs. Speed (mph)*



*CAT normalizes Performance to avoid inherent weighting anomalies.*

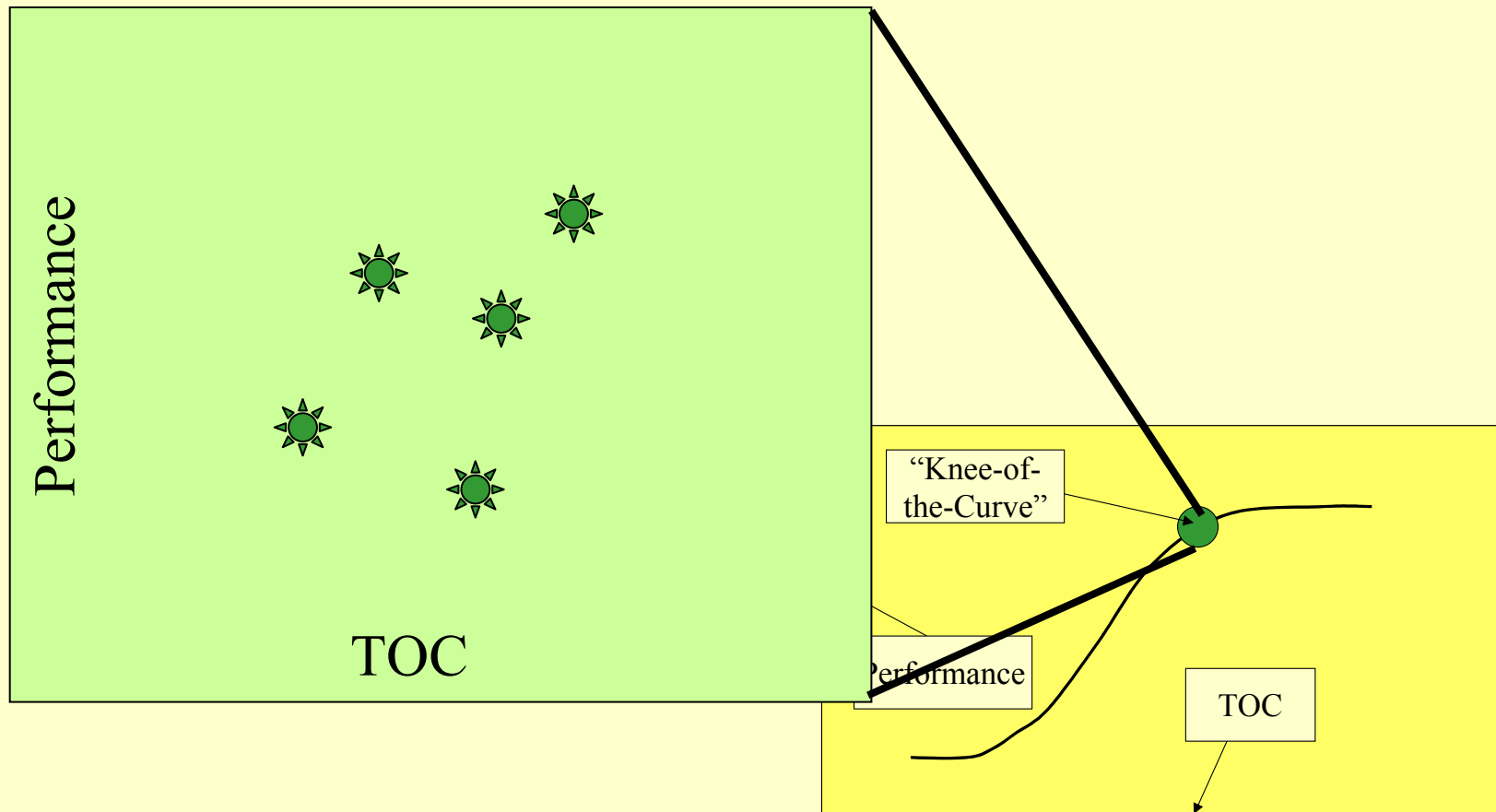




# Select the Best Value Component



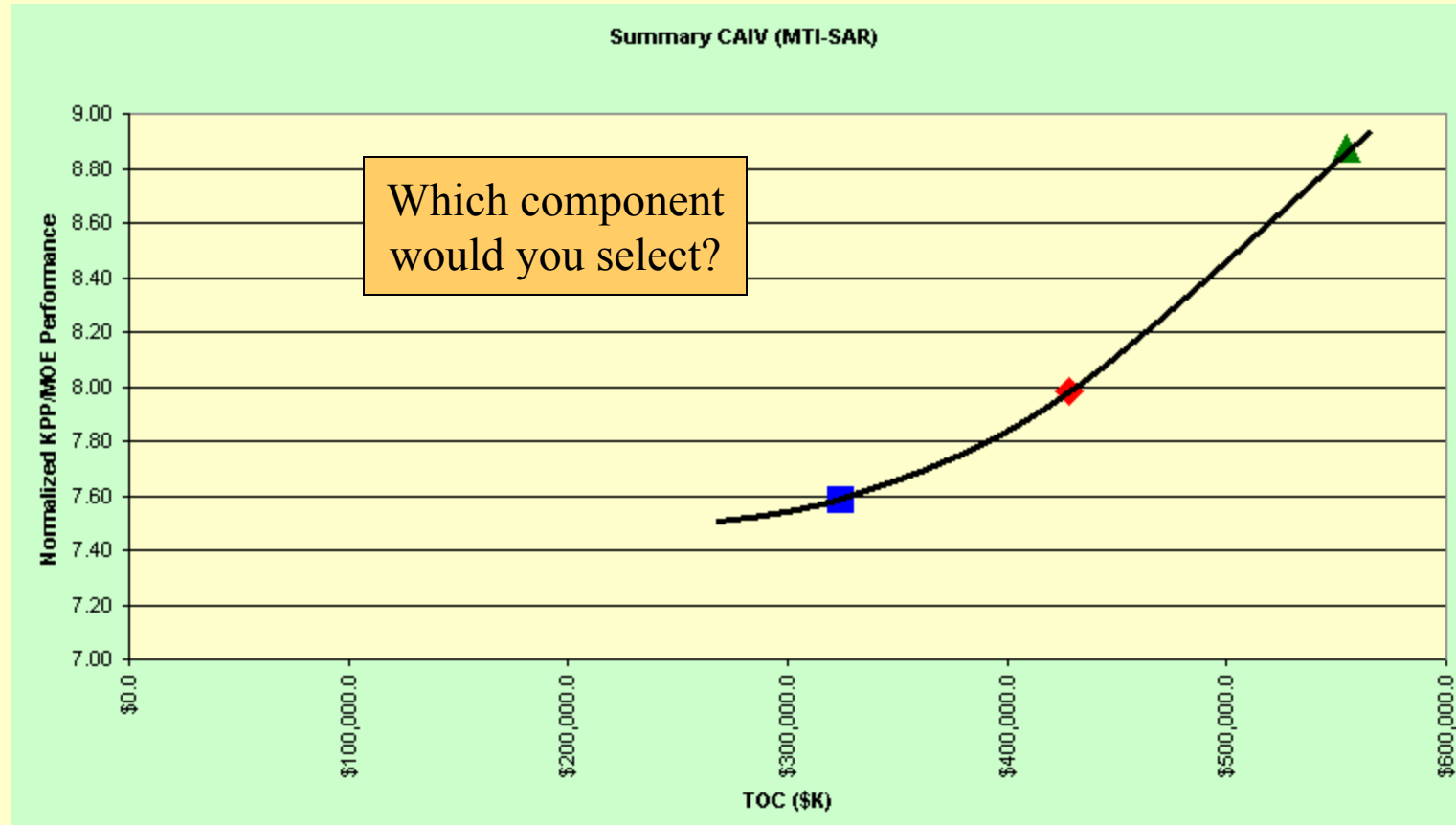
# Zoom-in on “Knee”



*What will the CAIV look like, when we zoom-in on the Knee.*



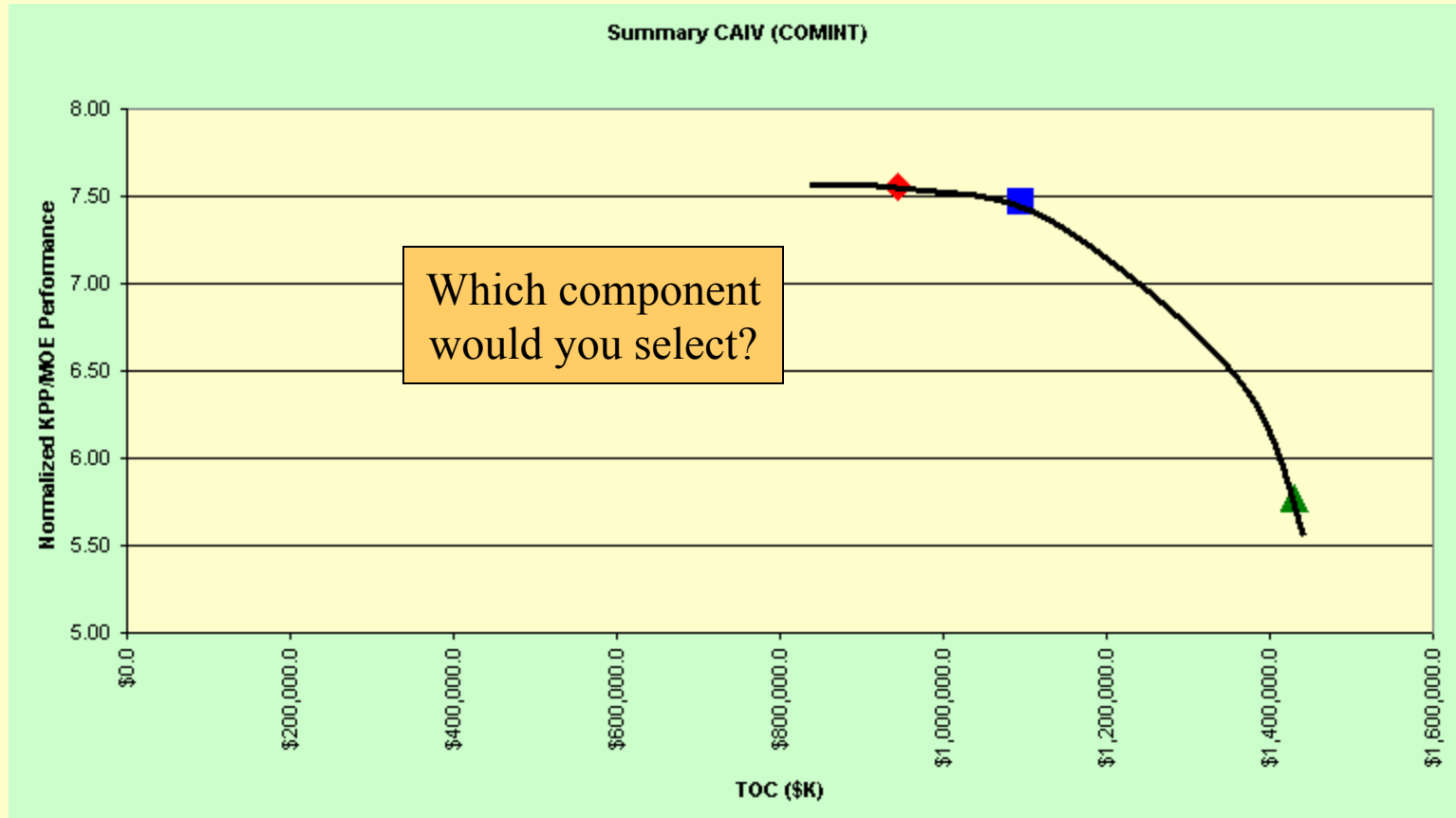
# Sample Component CAIV



*Sometimes we receive the statistical-purist's CAIV Curve.*



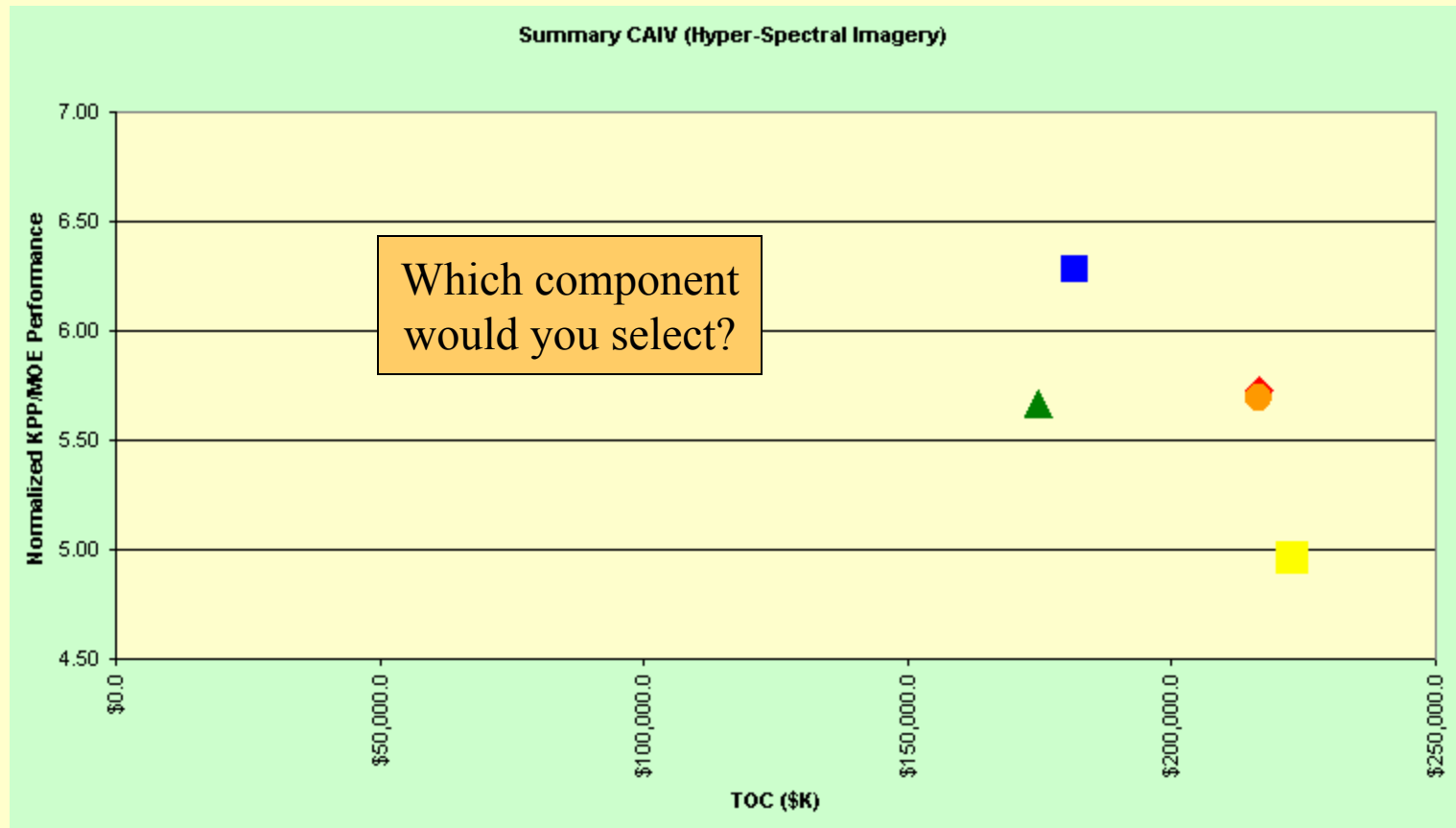
# Sample Component CAIV



*Sometimes we receive an inverted CAIV Curve.*



# Sample Component CAIV



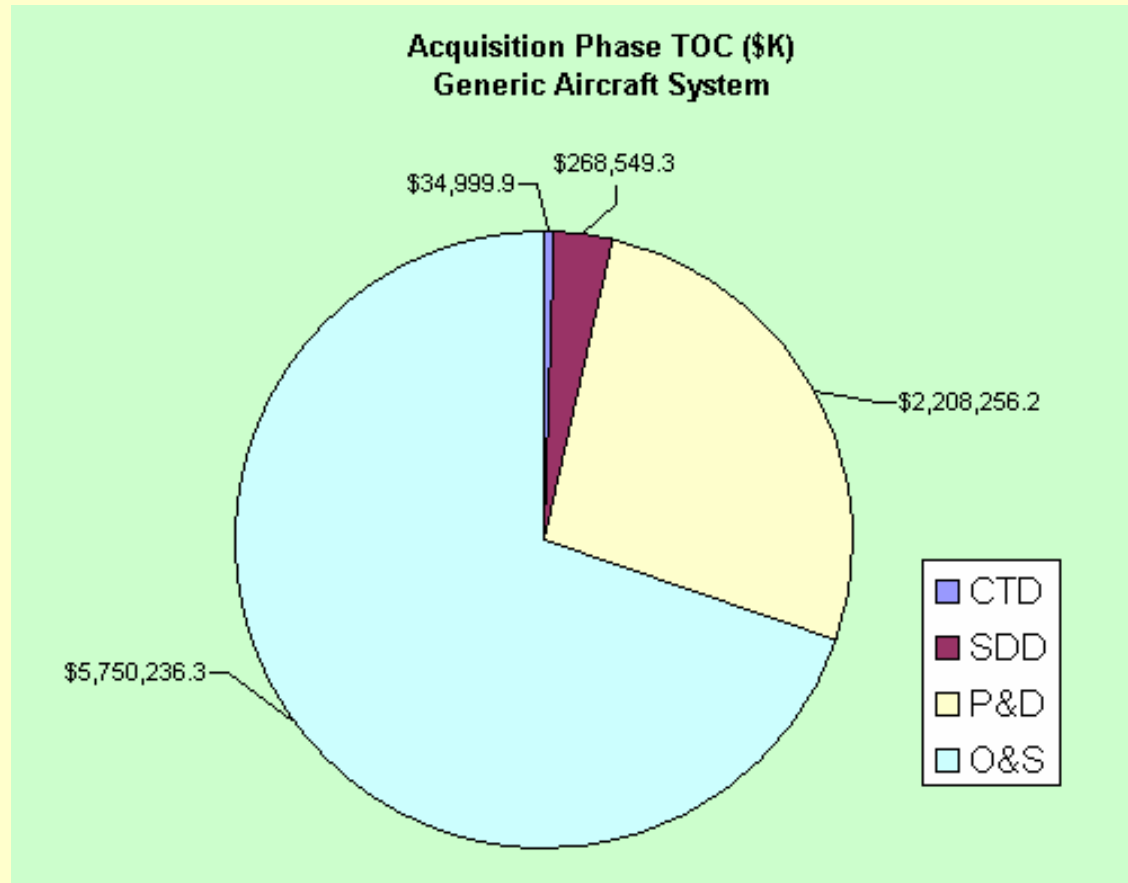
*Sometimes we receive a scatter of dots.*



# Other Graphs provided by CAT



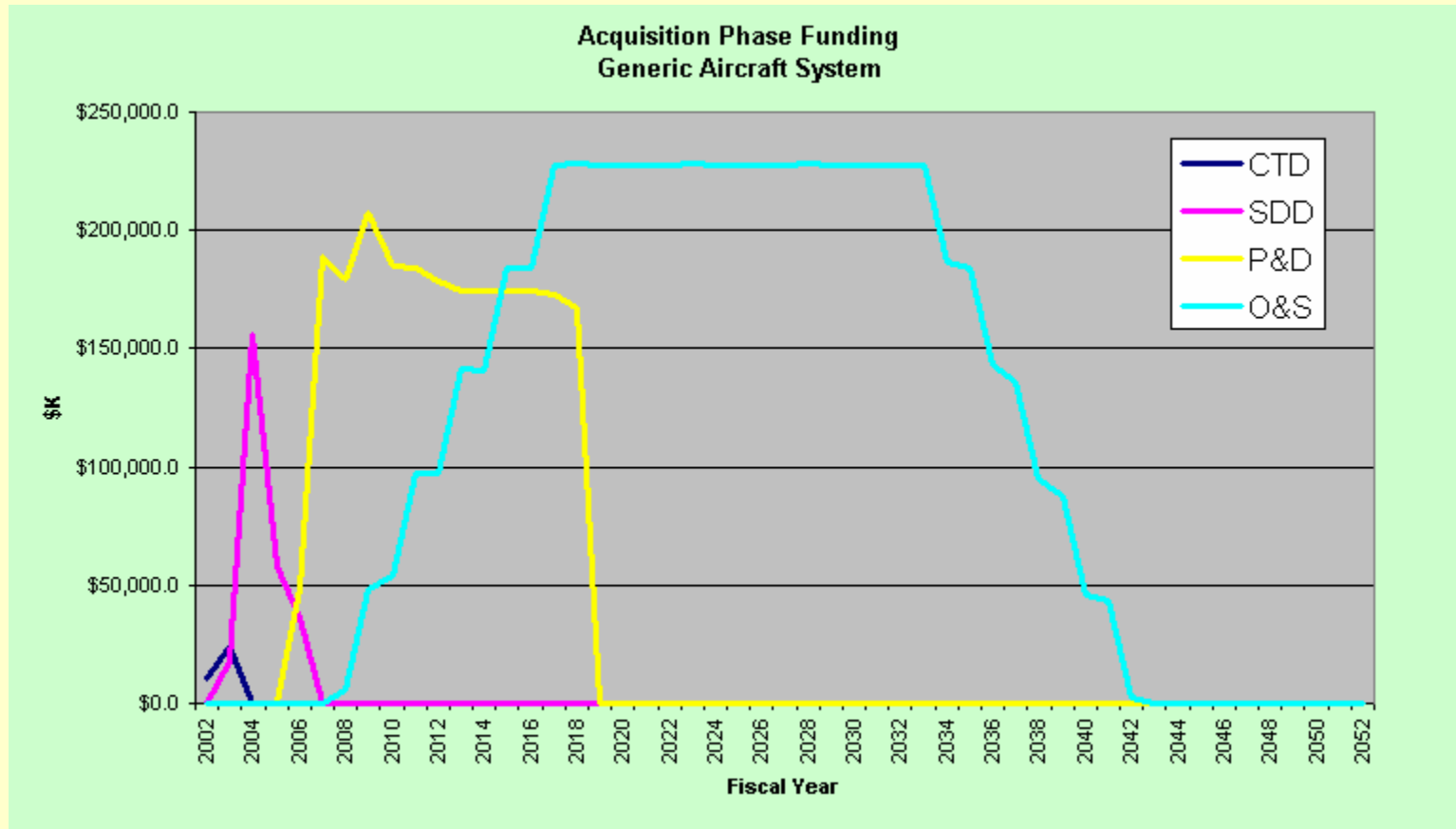
# Acquisition TOC



*CAT itemizes TOC by Acquisition Phase.*



# Acquisition Phase Funding



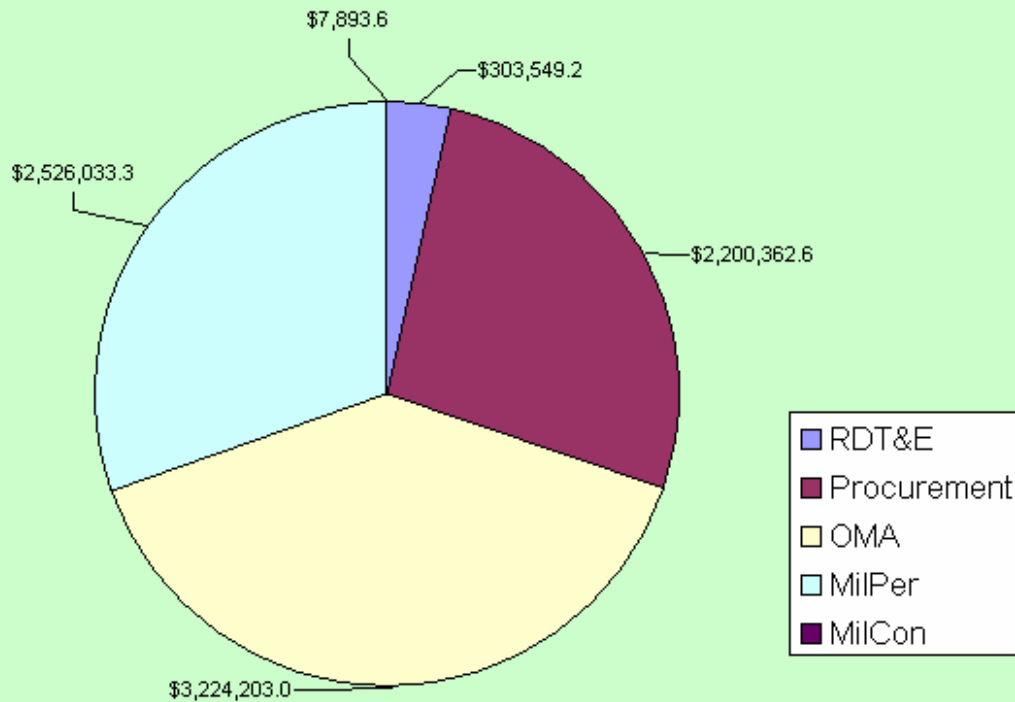
*CAT provides funding plan for each Acquisition Phase.*



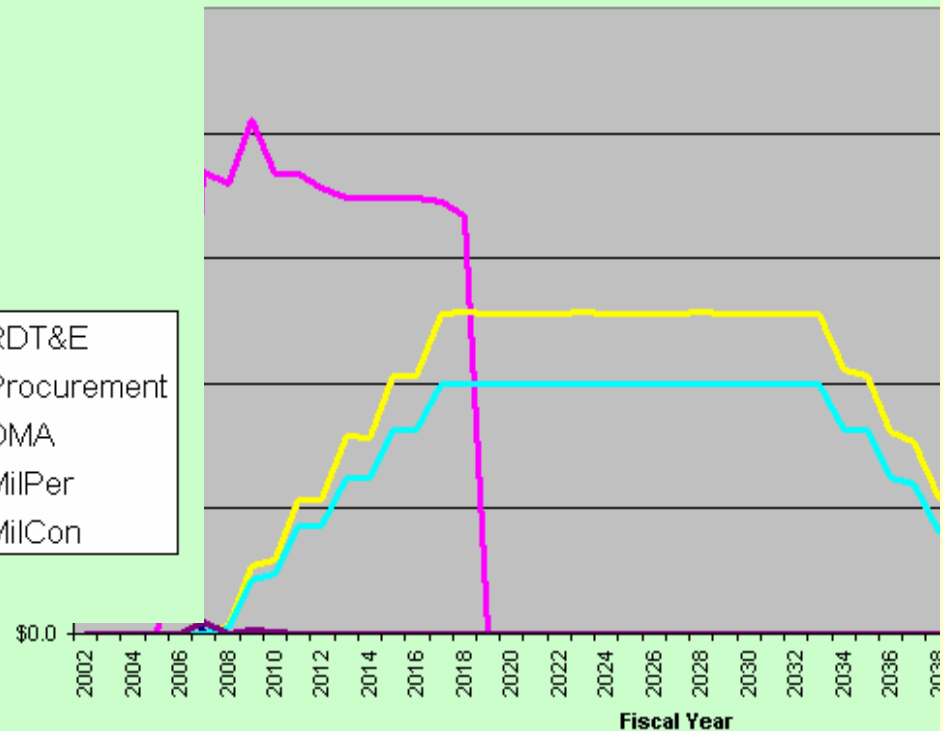


# Appropriation Funding

Appropriation Categories (\$K)  
Generic Aircraft System



Appropriations Fiscal Year Funding  
Generic Aircraft System



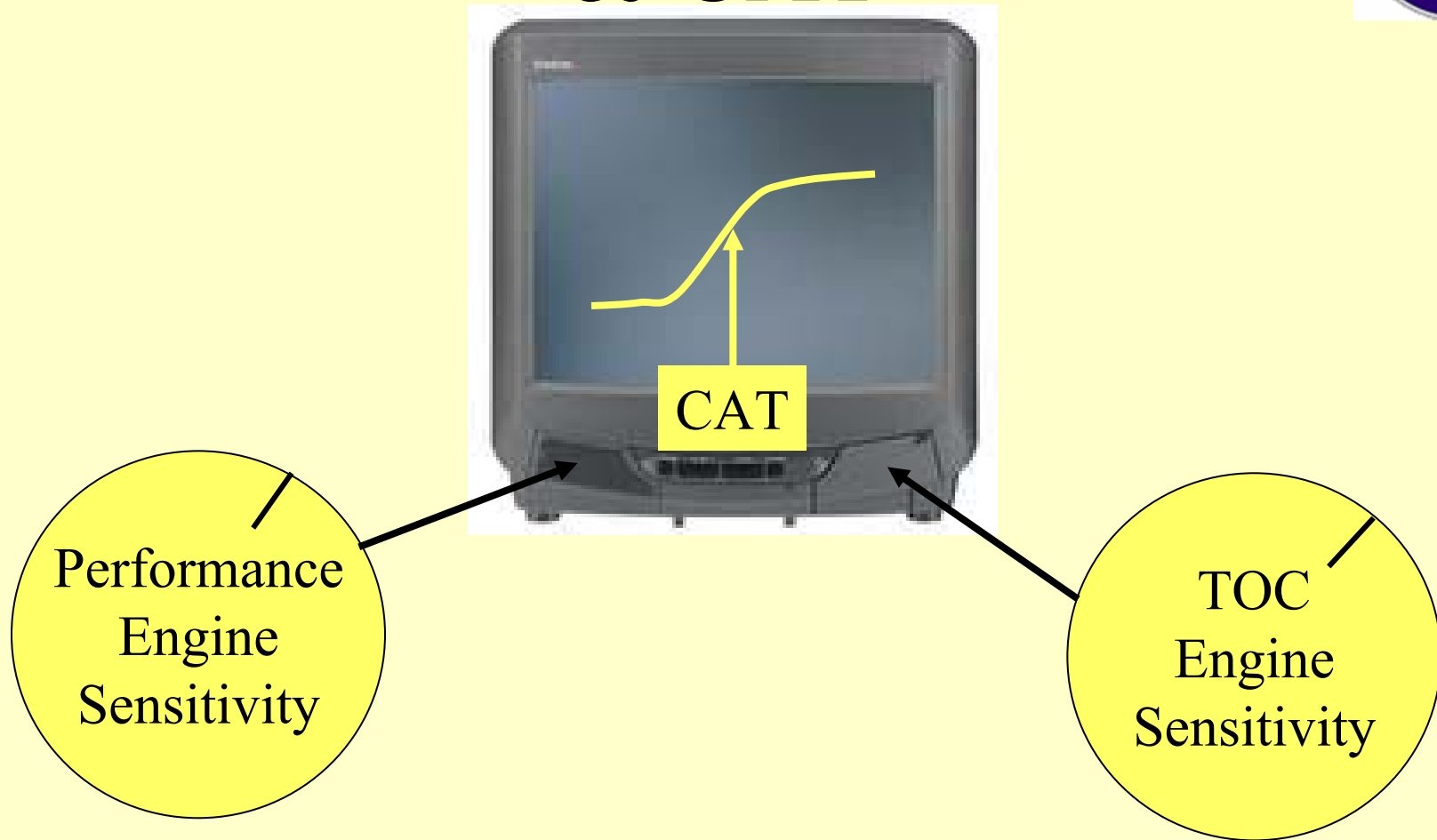
*CAT provides funding information for each Appropriation Category.*



# Conclusion



# Futuristic CAIV Model & CAT



*Control Knobs allow one to adjust Performance or TOC; CAT presents the results.*



# Conclusion

- The Army has a CAIV Vision.
- ASA(ALT) took an initial step to help CEAC fulfill the Army Vision.
- ASA(ALT) is committed to help CEAC fulfill the Army Vision.

Email [twm75402@saalt.army.mil](mailto:twm75402@saalt.army.mil)  
for a Beta Copy of CAT.